

# Binary Colloidal Alloy Test (BCAT-6):

- **Research Team:**  
Dr. Matthew Lynch and Tom Kodger, Procter & Gamble (P&G)  
Prof. David Weitz and Dr. Peter Lu, Harvard University  
Prof. Paul Chaikin and Dr. Andrew Hollingsworth, NYU  
Prof. Arjun Yodh and Dr. Zexin Zhang, UPenn
- **PS:** Dr. William Meyer, NCSE at NASA GRC
- **PM:** Donna Bohman, NASA GRC
- **Engineering Team:** ZIN Technologies, Inc.

## Objectives:

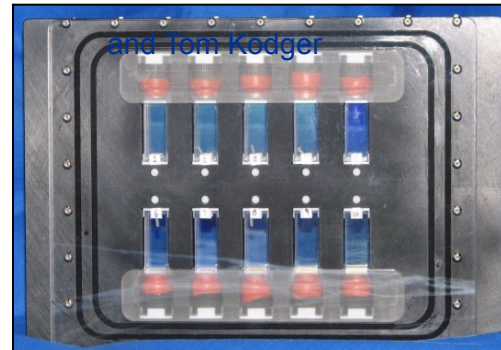
- ◆ Photograph colloid samples after they have been mixed (randomized) onboard the International Space Station (ISS) to observe the resulting structure and evolution in microgravity. Ten colloidal samples will study: aging of gels and late collapse (Lynch, Weitz, and Lu), wall seed initiated crystals in the absence of gravitational jamming (Chaikin and Hollingsworth), non-biological self-assembly with DNA (Chaikin and Hollingsworth), and 3D crystallization of disks, growth and melting (Yodh and Zhang).
- ◆ Measure phase separation rates in  $\mu$ -g to develop underlying theory for predicting product shelf-life (P & G). Collapse [irreversible separation] occurs on Earth and must be mitigated with expensive particle additives. Look closely at late collapse.

## Relevance/Impact:

- ◆ Phase separation data, which is not available on Earth; can guide our understanding of how to extend product shelf-life and product avoid collapse. Adding an additional dimension to existing BCAT data will help guide theory. Potential to significantly impact a \$100B/yr (world wide) industry.
- ◆ Crystallization of: spherical particles with larger seed particles; spheres using DNA for lock and key assembly; and disks will show us how order arises out of disorder. Some of this work will lay the foundations for using self-assembly in colloidal engineering.

## Development Approach:

- ◆ Flight design uses existing flight spare hardware; simple to fabricate.
- ◆ Using the EarthKAM set-up on the ISS with existing low-noise high-resolution Nikon camera reduces up-mass / volume, costs, and crew training, while increasing the quantity and quality of the data.



BCAT-6 Slow Growth Sample Module

## Glenn Research Center



BCAT experiment using the seat track setup in the Japanese Experiment Module (JEM)

<b>Accommodation (carrier)</b>	Space Shuttle
<b>Upmass (kg)</b> (w/o packing factor)	2.7 kg (BCAT-6 module) + batteries
<b>Volume (m<sup>3</sup>)</b> (w/o packing factor)	1.76 x 10 <sup>-3</sup>
<b>Power (kW)</b> (peak)	90 Watts + 42 Watts (laptop and camera) + 36 AA batteries
<b>Crew Time (Hrs)</b> (installation/operations)	36 Hrs. (BCAT-6, ~ Inc. 25-27)
<b>Autonomous Ops Time (hrs)</b>	2044 (BCAT-6, ~ Inc. 25-27)
<b>Launch / Increment</b>	Inc. 24 (ULF-6)

## Project Life Cycle Schedule

Milestones	SCR	RDR	PDR	CDR	VRR	Safety	FHA	Launch	Ops	Return	Final Report
<b>Actual/ Baseline (BCAT-6)</b>	HQ approval + 3 m	N/A	N/A	N/A	N/A	Apr 2010	May 2010	July 2010 (ULF-6)	N/A	TBD	N/A